Paper C4

An Integrated Petrophysical Analysis of Low Resistivity Low Contrast (LRLC) Pays in Clastic Reservoirs in Se Asia

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Jansz-Io Field is part of the Greater Gorgon Liquefied Natural Gas (LNG) Project on the Northwest Shelf of Australia. The reservoir consists of sub-tidal marine sandstones that will be developed in a present day deep water setting. The majority of the reservoir is highly bioturbated shaly sandstones with significant amounts of potassium feldspar and glauconite. The reservoir is capped with a medium to coarse grained sandstone with abundant iron-rich ooid grains and iron-rich cements including siderite, hematite, limonite, and an amorphous green clay mineral identified as berthierene, a form of chamosite.

The iron content strongly affects the Resistivity, Neutron and Density logs. As a result, previous conventional analyses mistakenly identified the interval as being clay bearing, in spite of the relatively clean Gamma Ray (GR). Applying the Elemental Capture Spectroscopy(ECS) interpretation using the standard WALK2 processing also incorrectly identified the interval as shale. Consequently, the grain density was significantly underestimated. This in turn resulted in a significant underestimation of porosity and permeability for the interval. In contrast, the full waveform sonic data clearly demonstrated the presence of a gas-bearing reservoir, and NMR data confirmed producible porosity and invasion of oil-based mud (OBM).

Apparently, the WALK2 ECS processing model was initially settled on due to the difficulty in distinguishing the iron and aluminum signals. A constant ratio of Al/Fe was assumed. At the recently drilled Jansz-4 well the NMR log was run at a relatively slow speed of 170 fph to facilitate full polarization of the gas. As a result, the combined ECS log was able to separate the measured Iron and Aluminum signals. Another lesser known ECS processing model, ALKNA, was then used to effectively identify the proper mineralogy. Based on the patent submission, this was the originally preferred processing model; however the Al/Fe issue rendered it impractical for most conventional reservoirs.

The ALKNA processing predicted the very high grain densities measured in core. The resulting higher porosity compounded with the large grain size of the upper sand facies resulted in much higher estimates of permeability. This new log-derived permeability-thickness has an improved match with the permeability derived from pressure transient analysis of production tests in two recent appraisal wells.

Iron-rich reservoirs remain as one of the most challenging FE interpretation environments. Detailed knowledge of mineralogy, mineral effects on all logging tools and an open mind in selecting processing methods is essential for a successful interpretation.

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